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MYERS BIGEL SIBLEY & SAJOVEC
PO BOX 37428
RALEIGH, NC 27627

EXAMINER	
WOODS, ERIC V	
ART UNIT	PAPER NUMBER
2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/815,281	Applicant(s) KIM ET AL.
	Examiner Eric Woods	Art Unit 2628

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,12,15-17,19 and 22-28* is/are rejected.

7)☒ Claim(s) *11,13,14,18,20 and 21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 22 May 2006 has been entered.

Response to Arguments

Applicant's arguments filed 22 May 2006 have been fully considered but they are not persuasive in certain respects and are persuasive in others.

Applicants arguments and claim amendments, filed 22 May 2006, are found to be persuasive with respect to the rejections of claims 1-7 and 22-28 under 35 USC 112, second paragraph.

The rejection of claims 1-7 and 22-28 under 35 USC 112, second paragraph, stands withdrawn.

The rejection of claims 1-10, 12, 15-17, 19, and 21-28 under 35 USC 103(a) stands withdrawn in view of applicant's amendments to the claims.

The rejection of claims 1-7 and 22-28 under 35 USC 112, first paragraph, are **NOT** withdrawn. The term 'computer' is read in its broadest reasonable interpretation. It is submitted that a Turing machine is a computer. That is, any system that uses digital logic to execute the above method – whether or not such a system is CPU and

the method is in software, or whether or not a system is an ASIC and the method is codified in hardware – is a computer. Therefore, examiner strongly disagrees with applicant's contention that such an amendment would in any way bar hardware embodiments. Applicant would not be conceding claim scope under *Festo* to accept such amendment. Nonetheless, examiner submits that an ASIC and the like – hardware implementations – are computers. As such, applicant's arguments are not found to be persuasive.

If applicant makes such an amendment, the record will show (as above) that such was not a concession of claim scope for hardware limitations, since examiner is stating that the definition of "computer" is being construed in such a way as to cover such implementations, although examiner believes that it does. However, examiner would find the language "computer or hardware implemented" to be acceptable in these circumstances if applicant were to make such an amendment, which would result in the withdrawal of the rejections under 35 USC 112, first paragraph.

The objections to claims 11, 13-14, 18, and 20 stand withdrawn in view of applicant's amendments to their parent claims.

However, upon further consideration, new grounds of rejection are applied against the claims as set forth below.

In any case, the amendment 'originally formatted input data' is not believed to change the scope of the claim, since the data that is being operated upon would inherently have some original format.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 4, and 15 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure that is not enabling. A computer – which is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Specifically, the method clearly is computer-implemented, but the preamble of the claim does not recite this. This rejection is necessitated by applicant's amendment. In any case, to correct this deficiency applicant merely needs to add the words 'computer-implemented' in front of the word 'method' in the preamble of the above mentioned claims.

Claims 2-7 and 16-21 are rejected as not correcting the deficiencies of their parent claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-2, 4, 22-23, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (US 6,714,242 B2) in view of Muresan et al (US PGPub 2004/0086201 A1).

As to claims 1 and 22,

A method of interpolating pixel data in scaling pixel data for display, the method comprising:

-Determining a pixel value at an interpolation location of a display based on filtering originally formatted pixel data surrounding the interpolation location in a plurality of directions from the interpolation location, wherein determining a pixel value comprises: (Kobayashi teaches the use of various directions by filtering pixels proximate to a specific pixel, see for example the low pass filters in Figure 7, where the filter kernel values are listed, as well as the scaling coefficients therein. Further, 4:30-38 teaches that a plurality of directions are applied to the location to be interpolated, particularly four diagonal directions. Specifically, the 5:57-6:15 system of Kobayashi clearly takes into account pixels nearby to the pixel being interpolated, and the system of Kobayashi clearly interpolated – see 1:5-35, the prior art clearly uses bounded convolution kernel,

and 1:55-2:45 teaches that the present system of Kobayashi performs as required. Kobayashi obviously obtains image data initially in some format from the CCD)(Muresan clearly teaches that pixels are interpolated in various directions, as in Figures 3 and 4, where clearly the Original Image in Figure 1(a) has an initial format, and clearly an 'original image' is originally formatted)

-Low-pass filtering the data surrounding the interpolation location to determine a direction of interpolation for the interpolation location; (Kobayashi clearly filters low-pass data in 6:1-15, in Figure 7, and the like, where this clearly involves filtering data proximate to the interpolation location, where it is clear that Kobayashi has a complete knowledge of the underlying LPF filter characteristics and the like)

-Calculating pixel data values at points where a line that passes through the interpolation location and extending in the direction of interpolation intersects horizontal or vertical lines of the display, wherein the points are not included in the originally formatted input pixel data; (Kobayashi corrects problems of the prior art, such as specified in 1:40-50, where the prior or conventional art has difficulty detecting intersection of various edges or lines, so the system of Kobayashi inherently performs this function as specified by the instant claim, note that Kobayashi utilizes pixels that are close to each other, and these clearly require that the image be 2:15-40 interpolated between already existing pixels, where since diagonal directions are utilized for the interpolation process, this clearly requires that the diagonal directions be on the same line that intersect s pixels in the vertical and horizontal directions as recited in this portion of the claim)(Muresan clearly

teaches that finding intersections between horizontal and vertical pixels are important – see [0005], note in Figures 3 and 4A-4B, where the diagonal grid is created, such that interpolation locations within each pixel are created, and that interpolation directions clearly intersect the original pixels in at least the corners, which is inherent to how the system of Muresan operates, where this algorithm is used to derive the other pixels, as in Figure 6 where in [0038-0042] one-dimensional interpolation is performed in the desired direction, which clearly requires the line as recited in the present application, and this clearly intersects vertical and/or horizontal lines o the display, since an image is made of rows and columns in the first place, as is a raster-type display devices, which therefore means that the line is inherent, since the image is being interpolated, which generates a larger version that will also be in raster format. Finally, the system of Muresan clearly generates pixels that are not included in the original image, since the image is being upscaled, prima facie the lines created will intersect horizontal and vertical lines of the display. Further, these points do clearly exist and are used for interpolation, since the image is upscaled by a factor of K – see [0005-0008] and Figure 3)

-Filtering the pixel data values at the points to provide an interpolated pixel value at the location of interpolation; and (Kobayashi clearly filters the data, as set forth in many locations above, and further in Figure 13 and Figs 10-12. Clearly, this filtering is performed at the data points as required, since those filters utilize existing data points to generate the desired results).

-Providing the interpolated pixel value to the display to provide a scaled-up image thereon compared to the originally formatted input pixel data. (Muresan clearly generates the scaled-up image, as in Figures 3 and 4 with the upsampled version of the image, and the like)

Kobayashi teaches most of the limitations of the instant claims with certain details concerning filtering in the diagonal direction, and Muresan teaches those details. Kobayashi is being modified by certain techniques of Muresan, so it is not a combination per se. Next, note that Kobayashi does **not** downsample the image (as in Muresan [0055] so the combination is a valid one and does not change the principle of operation. Rather, Kobayashi does not apply certain filtering in the diagonal direction, whilst it would be obvious to do so in light of the teachings of Muresan, since the techniques of Muresan avoid extraneous calculation and prevent certain ringing artifacts (e.g. Figures 8a vs. 8b). Further, the system of Kobayashi determines the most effective interpolation methods in detecting circuit 14 in Figure 1 --note 4:8-18. Therefore, for situations where that portion of the interpolation algorithm would be appropriate, the modified techniques of Muresan would be applied as per the modification above, and the detection of correlation in that manner is important, note 4:30-40, which therefore would call for the use of diagonal filtering additionally, and the method of Muresan would clearly provide that in addition to the standard horizontal and vertical interpolation techniques common between both applications. Further, the system of Kobayashi performs filtering upon the four directions per se, which

corresponds to the non-diagonal image of Muresan as element 5 in Figure 1 (Muresan), and the system of Muresan thusly provides more accurate results by providing the diagonal version, which enhances the diagonal correlations of Kobayashi as set forth therein (2:65-3:10, 4:30-40), and the diagonal image would be the logical extension of the diagonal testing techniques of Kobayashi in 4:30-40 and the like. More details will be provided upon request. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kobayashi in light of Muresan for at least the above reasons, and since Muresan saves unnecessary calculations and the like, thus making the end product run faster. Also, something else is noted – the system of Kobayashi uses low-pass filters to avoid artifacts, which would help. Finally, as noted above in the arguments the newly applied references clearly calculate pixels on diagonal lines that clearly lie between already existing pixels, such that a being interpolated that lies on the diagonals is clearly on a line, and is clearly interpolated. Merely because the line may pass through existing display points does not mean that such points therein are **not** calculated by being on such a specified line. Namely, the pixels on the diagonals must prima facie be on a line. Applicant still has not narrowed the claims sufficiently to exclude this particular interpretation.

As to claims 2 and 23, clearly Kobayashi considers multiple directions as required in the above claim (4:30-40, see Abstract, etc).

As to claims 4 and 25, this is very similar to claim 1, the rejection to which is incorporated by reference. The only difference is that filtering is clearly done in the direction of interpolation to determine pixel data values at points on a line that intersects

horizontal or vertical lines of the display, which Kobayashi obviously does. Kobayashi Abstract teaches that, as does Muresan, and this has been thoroughly discussed as above.

Claims 3, 5-6, 8, 15, 24, and 26-27 are rejected under 35 U.S.C. 103(a) as unpatentable over Kobayashi in view of Muresan as applied to claims 1 and 22 respectively, and further in view of Greggain.

As to claims 3 and 24, examiner maintains that applicant has not demonstrated any criticality with regards to the number of directions required for interpolation. Further, both Kobayashi and Muresan teach the use of 8 directions. Therefore, such a limitation is entirely a matter of design choice. However, to expedite prosecution, Greggain is brought in, since Greggain teaches seven directions in 2:64-67, and also 21:60-67. It would have been obvious to combine Kobayashi/Muresan in view of Greggain to one of ordinary skill in the art at the time the invention was made in light of the above and further since Greggain handles situations regarding low-frequency edges in a good manner and interpolates in such a way as to avoid creating artifacts from them per se and also 2:15-3:56 where more benefits are enumerated.

As to claims 5 and 26, Greggain teaches the use of polyphase filtering in 25:45-55 (claims 39 and 40) in the direction of interpolation, where the polyphase filters are used in the directional interpolator. The rejection to the claim 3 is herein incorporated by reference.

As to claims 6 and 27, see the rejection to claim 5 above; the only difference is that filtering the pixel data values clearly consists of retrieving coefficients for processing the pixel values (e.g. for the filter (see Greggain claim 40, 25:45-55)), and this claim is substantially the same as that for claim 5, furthermore the reference performs both filtering of the direction of interpolation and the data values in the method listed in 2:5-30 as stated therein. The rejection to the claim 3 is herein incorporated by reference.

As to claims 8 and 15, reference Greggain teaches the use of a directional interpolator explicitly in 25:45-55, where the directional interpreters use polyphase filtering to the steps listed in 2:12-35, which clearly recite in the details of the implementation (2:33-65) the use of the intersection of lines at different angles (see for example Figs. 15-22) with horizontal and/or vertical lines of screen data, where clearly for example seven lines (2:64-67) are used. Reference Greggain also clearly determines the direction of a plurality of lines passing through an interpolation location and determines a direction value (e.g. steps (i) and (ii) on 2:12-35), and clearly it outputs that value, given that interpolation occurs (e.g. steps (iii) and (iv)). Otherwise, the rejection is like unto that of claim 1, which is incorporated by reference. Motivation and combination are incorporated by reference from the rejection of claim 3. The rejection to claim 4 is herein incorporated by reference in its entirety, as it deals with other specific issues associated with the low-pass filtering and line intersection questions, e.g. it covers the fact that Greggain also teaches interpolation based on intersection with vertical lines as well as horizontal ones.

Claims 7 and 28 are rejected under 35 U.S.C. 103(a) as unpatentable over Kobayashi in view of Muresan as applied to claim 4 above, and further in view of Shimizu.

Kobayashi and Muresan teach this limitation implicitly, whilst Shimizu teaches it explicitly, in 2:5-15 where a method commonly known in the art is taught to have an expanded line that differs depending on the coordinate position. Shimizu teaches weighting pixels differently based on their location with respect to the interpolated line in (5:25-34) with specific details of the (7:10-25) weighting algorithm for each pixel provided in the weighting unit 14 in Fig. 1. It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the systems of Kobayashi/Muresan and Shimizu for the above reasons and it would have been obvious to modify the system of Kobayashi/Shimizu to utilize both direction of interpolation and spatial location information during the interpolation process as set forth by Shimizu.

Claims 9-10, 12, 16-17, and 19 are rejected under 35 U.S.C. 103(a) as unpatentable in view of Kobayashi, Muresan, and Greggain as applied above, and further in view of Shimizu.

As to claims 9 and 16, this claim is similar to claim 8, the rejection to which is herein incorporated by reference in its entirety. The main difference is that the system of claim 9 has a memory unit, which Shimizu teaches as pixel value buffer 22 in Fig. 2, which receives input pixel data from the original image data input unit 11, and it updates and stores pixel data as required. Further, it also has a source index buffer 28, where

the image is stored after has the rules applied to it and after it is processed for interpolation (as stated on the label to element 28), and to which the results of the interpolation are stored as recited in the claim. Obviously, a buffer would output its contents on receipt of a control signal, which Shimizu provides in 16:1-13, where it is stated "program control thereafter advances to the next coordinate position", e.g. the system moves the data in the buffers when a controller sends a control signal, since pixel value buffer 22 is stated to contain the eight pixels surrounding the region being interpolated, and those would be moved when the program signals to continue with the next pixel. Finally, Shimizu teaches that the system is intended to be a controller (8:60-65) so it would prima facie send control signals.

Given that the system of Shimizu moves from one pixel to another after performing the interpolation step (which the method listed in Greggain (e.g. 2:12-35) would prima facie require) it would be obvious that it has a controller as stated above. Obviously, the filtering takes place as each pixel is examined, and so any control signal that moves data into an out of the buffers after it is filtered also controls the LPF filtering (as this happens before the data is actually interpolated) and thusly the polyphase filtering that takes place during the process.

Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example), It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the system of Greggain with that of Shimizu to get the normal lowpass filtering added in to the system, given that utilizing such methods is required in the art as set forth above, and for the fact that Greggain implicitly

teaches this limitation anyway (e.g. Fig. 23A and 2:5-17). Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example), It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the system of Greggain with that of Shimizu to get the normal lowpass filtering added in to the system, given that utilizing such methods is required in the art as set forth above, and for the fact that Greggain implicitly teaches this limitation anyway (e.g. Fig. 23A and 2:5-17). Motivation to combine the other references is taken from the rejection to claims 1 and 7 above and is incorporated by reference.

As to claims 10 and 17, this claim is very similar to claim 8, the rejection to which is herein incorporated by reference. The main difference is that the direction determination unit performs the LPF filtering in response to the control signal. This difference is obvious and is actually inherent, because the system is known to perform the LPF filtering before the polyphase filtering, e.g. according to Shimizu as stated in the rejection to claim 4, the LPF is applied during the interpolation process, and Greggain clearly teaches in 2:5-35 that "First, an interpolation direction is selected corresponding to any low-frequency edges in the source data." This clearly states that low-frequency components are essential to the interpolation process. In order for those to be extracted, a lowpass filter would have to be applied. Then, once those were located, that would be included in step (i) of the method listed therein. Thusly, the LPF would be applied before the polyphase filtering actually took place, which would meet the requirements of the claim as stated above. Motivation and combination are taken from the rejection to the parent claim.

As to claims 12 and 19, reference Greggain clearly teaches in 21:65-67 and 22:25-67 where it is stated that the direction interpolation is varied depending on the angles found on the various vertical and oblique lines tested, where in claim 3 it clearly states that seven directions are used for determining interpolation, which would clearly result in the division of interpolation regions into seven values, with each having an assigned number that would be in format like unto the system recited in claim 13, where each direction value would take on the values of the directions recited in Greggain. Further, in 7:30-67 it is clearly taught that the quadrant of the (e.g. the determination of position) is made based on a computed alpha value for determining the directionality for the intermediate pixels. This clearly illustrates the principle of linear change based on determined direction, as illustrated in 7:53-60. As taught in 8:25-38, based on the direction, the direction is found by interpolating linearly between the endpoints of the interpolated pixel, and based on the concept of the intermediate pixel. The concept of alpha – positive or negative for both x and y axes allows a quick determination of whether or not the pixels is above or to the left of the pixel being interpolated, which then fulfills the recited limitation of linear change between a pixel above or the left and a pixel below or to the right, as clearly those pixels are necessary to form the endpoints for determining the direction as recited 8:25-40. Motivation and combination are taken from the rejection to claim 10 above.

Claims 1-10, 12, 15-17, 19, and 22-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greggain as applied to claim 1 above, and further in view of Shimizu (US 6,816,166 B2)('Shimizu'). (Claims 22-24 are merely a computer program implementing the methods of claims 1-3 so the rejections valid on claim1 are equally valid on them).

As to claims 1 and 2,

A method of interpolating pixel data in scaling pixel data for display, the method comprising:

-Determining a pixel value at an interpolation location of a display based on filtering originally formatted pixel data surrounding the interpolation location in a plurality of directions from the interpolation location, wherein determining a pixel value comprises: (Greggain teaches the use of his invention for interpolating video images (1:8-30) for arbitrary scaling or resizing factors (2:5-130) for pixels, where the system considers pixel values around a location (2:5-32), where clearly the video data is an original format. Figures 1-6 and 15-22 shows the various directions that the image is interpolated in from the initial interpolation location. Greggain teaches the use of his invention for interpolating video images (1:8-30) for arbitrary scaling or resizing factors (2:5-130) for pixels, where the system considers pixel values around a location (2:5-32). filtering the direction of interpolation to determine pixel data values on points on a line that intersects horizontal or vertical lines of the display in (2:29-40 for example, where vertical lines are taught) and the directionality and filtering is taught in (2:5-30). Prima

facie, interpolation in this manner is clearly filtering. Further, step (iii) of the Greggain reference clearly teaches interpolating data based on a direction of interpolation based on the region surrounding the pixel of interest – step (ii), where these are on a line that intersects vertical lines of the display (e.g. step iii) and clearly Figs. 15-22 illustrate that. Greggain further teaches that it is determined which directions may have a low-frequency edge, e.g. step 216 in Fig. 23A and 2:5-17. Reference Shimizu clearly teaches lowpass filtering the image as well known in the art (1:10-26) and further that such is required (1:58-2:5) and that scaling requires the lowpass filter (3:64-4:10) and that his system uses it (4:40-50). Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example).)

-Low-pass filtering the data surrounding the interpolation location to determine a direction of interpolation for the interpolation location; (Greggain further teaches that it is determined which directions may have a low-frequency edge, e.g. step 216 in Fig. 23A and 2:5-17. Reference Shimizu clearly teaches lowpass filtering the image as well known in the art (1:10-26) and further that such is required (1:58-2:5) and that scaling requires the lowpass filter (3:64-4:10) and that his system uses it (4:40-50). Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the system of Greggain with that of Shimizu to get the normal lowpass filtering added in to the system, given that utilizing such methods is required in the art as set forth above, and for the fact that Greggain implicitly teaches this limitation anyway (e.g. Fig. 23A and 2:5-17))

-Calculating pixel data values at points where a line that passes through the interpolation location and extending in the direction of interpolation intersects horizontal or vertical lines of the display, wherein the points are not included in the originally formatted input pixel data; (Further, step (iii) of the Greggain reference clearly teaches interpolating data based on a direction of interpolation based on the region surrounding the pixel of interest – step (ii), where these are on a line that intersects vertical lines of the display (e.g. step iii) and clearly Figs. 15-22 illustrate that. Greggain further teaches that it is determined which directions may have a low-frequency edge, e.g. step 216 in Fig. 23A and 2:5-17. Greggain implicitly teaches this limitation anyway (e.g. Fig. 23A and 2:5-17). Specifically, the horizontal line interpolation is shown in Figures 2-6. As to the **points not being included in the originally formatted input pixel data**, note the Abstract of Greggain: "An interpolation direction based on the comparison [pixels of different lines of the source data in a regions surrounding the upsampled target pixel **to be generated**] is selected and interpolations **between** selected pixels of the source data in the determined interpolation direction are carried out to compute intermediate pixels on a line segment passing through the upsampled target pixel. An interpolation **between the intermediate pixels** is carried out to generate the upsampled target pixel". Obviously, the direction determinations and the generated pixels do not and are not included in the originally formatted data.)

-Filtering the pixel data values at the points to provide an interpolated pixel value at the location of interpolation; and (Greggain further teaches that it is determined

which directions may have a low-frequency edge, e.g. step 216 in Fig. 23A and 2:5-17. Reference Shimizu clearly teaches lowpass filtering the image as well known in the art (1:10-26) and further that such is required (1:58-2:5) and that scaling requires the lowpass filter (3:64-4:10) and that his system uses it (4:40-50)).

-Providing the interpolated pixel value to the display to provide a scaled-up image thereon compared to the originally formatted input pixel data. (Greggain clearly generates upsampled data and then provides it to the display to be shown to the user, where the upsampled video clearly is provided.)

Reference Shimizu clearly teaches low pass filtering the image as well known in the art (1:10-26) and further that such is required (1:58-2:5) and that scaling requires the low pass filter (3:64-4:10) and that his system uses it (4:40-50). Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example), It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the system of Greggain with that of Shimizu to get the normal lowpass filtering added in to the system, given that utilizing such methods is required in the art as set forth above, and for the fact that Greggain implicitly teaches this limitation anyway (e.g. Fig. 23A and 2:5-17).

As to claims 2 and 23, Greggain clearly teaches multiple directions (e.g. n>2) in 2:33-63. Since only the primary reference is utilized, no separate motivation or combination is required and that from the rejection to the parent claim is herein incorporated by reference. (See Figs. 15-22).

As to claims 3 and 24, Greggain clearly teaches seven directions in 2:64-67, and also 21:60-67. Since only the primary reference is utilized, no separate motivation or combination is required and that from the rejection to the parent claim is herein incorporated by reference.

As to claims 4 and 25, Greggain clearly teaches all the limitations except explicitly stating that low-pass filtering is taking place by filtering the direction of interpolation to determine pixel data values on points on a line that intersects horizontal or vertical lines of the display in (2:29-40 for example, where vertical lines are taught) and the directionality and filtering is taught in (2:5-30). Prima facie, interpolation in this manner is clearly filtering. Further, step (iii) of the Greggain reference clearly teaches interpolating data based on a direction of interpolation based on the region surrounding the pixel of interest – step (ii), where these are on a line that intersects vertical lines of the display (e.g. step iii) and clearly Figs. 15-22 illustrate that. Greggain further teaches that it is determined which directions may have a low-frequency edge, e.g. step 216 in Fig. 23A and 2:5-17. Reference Shimizu clearly teaches lowpass filtering the image as well known in the art (1:10-26) and further that such is required (1:58-2:5) and that scaling requires the lowpass filter (3:64-4:10) and that his system uses it (4:40-50). Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example), It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the system of Greggain with that of Shimizu to get the normal lowpass filtering added in to the system, given that utilizing such methods is

required in the art as set forth above, and for the fact that Greggain implicitly teaches this limitation anyway (e.g. Fig. 23A and 2:5-17).

As to claims 5 and 26, Greggain teaches the use of polyphase filtering in 25:45-55 (claims 39 and 40) in the direction of interpolation, where the polyphase filters are used in the directional interpolator. Since only the primary reference is utilized, no separate motivation or combination is required and that from the rejection to the parent claim is herein incorporated by reference.

As to claims 6 and 27, see the rejection to claim 5 above; the only difference is that filtering the pixel data values clearly consists of retrieving coefficients for processing the pixel values (e.g. for the filter (see claim 40, 25:45-55)), and this claim is substantially the same as that for claim 5, furthermore the reference performs both filtering of the direction of interpolation and the data values in the method listed in 2:5-30 as stated therein. Since only the primary reference is utilized, no separate motivation or combination is required and that from the rejection to the parent claim is herein incorporated by reference.

As to claims 7 and 28, Greggain teaches this limitation implicitly whilst Shimizu teaches it explicitly, in 2:5-15 where a method commonly known in the art is taught to have an expanded line that differs depending on the coordinate position. Shimizu teaches weighting pixels differently based on their location with respect to the interpolated line in (5:25-34) with specific details of the (7:10-25) weighting algorithm for each pixel provided in the weighting unit 14 in Fig. 1. It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the

systems of Greggain and Shimizu for the above reasons and it would have been obvious to modify the system of Greggain to utilize both direction of interpolation and spatial location information during the interpolation process as set forth by Shimizu.

As to claims 8 and 15, reference Greggain teaches the use of a directional interpolator explicitly in 25:45-55, where the directional interpreters use polyphase filtering to the steps listed in 2:12-35, which clearly recite in the details of the implementation (2:33-65) the use of the intersection of lines at different angles (see for example Figs. 15-22) with horizontal and/or vertical lines of screen data, where clearly for example seven lines (2:64-67) are used. Reference Greggain also clearly determines the direction of a plurality of lines passing through an interpolation location and determines a direction value (e.g. steps (i) and (ii) on 2:12-35), and clearly it outputs that value, given that interpolation occurs (e.g. steps (iii) and (iv)). Reference Shimizu teaches the use of lowpass filtering on input data to help obtain direction information. Further, Shimizu teaches in Fig. 7B that values are checked to determine the number of pixels required on both sides of the reference.

The rejection to claim 4 is herein incorporated by reference in its entirety, as it deals with other specific issues associated with the low-pass filtering and line intersection questions, e.g. it covers the fact that Greggain also teaches interpolation based on intersection with vertical lines as well as horizontal ones. Motivation and combination is thusly taken from the rejection to claim 4 and incorporated herein by reference.

As to claims 9 and 16, this claim is similar to claim 8, the rejection to which is herein incorporated by reference in its entirety. The main difference is that the system of claim 9 has a memory unit, which Shimizu teaches as pixel value buffer 22 in Fig. 2, which receives input pixel data from the original image data input unit 11, and it updates and stores pixel data as required. Further, it also has a source index buffer 28, where the image is stored after has the rules applied to it and after it is processed for interpolation (as stated on the label to element 28), and to which the results of the interpolation are stored as recited in the claim. Obviously, a buffer would output its contents on receipt of a control signal, which Shimizu provides in 16:1-13, where it is stated "program control thereafter advances to the next coordinate position", e.g. the system moves the data in the buffers when a controller sends a control signal, since pixel value buffer 22 is stated to contain the eight pixels surrounding the region being interpolated, and those would be moved when the program signals to continue with the next pixel. Finally, Shimizu teaches that the system is intended to be a controller (8:60-65) so it would prima facie send control signals.

Given that the system of Shimizu moves from one pixel to another after performing the interpolation step (which the method listed in Greggain (e.g. 2:12-35) would prima facie require) it would be obvious that it has a controller as stated above. Obviously, the filtering takes place as each pixel is examined, and so any control signal that moves data into an out of the buffers after it is filtered also controls the LPF filtering (as this happens before the data is actually interpolated) and thusly the polyphase filtering that takes place during the process.

Clearly, given that such scaling requires the presence of a lowpass filter (4:10-41 for example), It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the system of Greggain with that of Shimizu to get the normal lowpass filtering added in to the system, given that utilizing such methods is required in the art as set forth above, and for the fact that Greggain implicitly teaches this limitation anyway (e.g. Fig. 23A and 2:5-17).

As to claims 10 and 17, this claim is very similar to claim 8, the rejection to which is herein incorporated by reference. The main difference is that the direction determination unit performs the LPF filtering in response to the control signal. This difference is obvious and is actually inherent, because the system is known to perform the LPF filtering before the polyphase filtering, e.g. according to Shimizu as stated in the rejection to claim 4, the LPF is applied during the interpolation process, and Greggain clearly teaches in 2:5-35 that "First, an interpolation direction is selected corresponding to any low-frequency edges in the source data." This clearly states that low-frequency components are essential to the interpolation process. In order for those to be extracted, a lowpass filter would have to be applied. Then, once those were located, that would be included in step (i) of the method listed therein. Thusly, the LPF would be applied before the polyphase filtering actually took place, which would meet the requirements of the claim as stated above. Motivation and combination are taken from the rejection to the parent claim.

As to claims 12 and 19, reference Greggain clearly teaches in 21:65-67 and 22:25-67 where it is stated that the direction interpolation is varied depending on the

angles found on the various vertical and oblique lines tested, where in claim 3 it clearly states that seven directions are used for determining interpolation, which would clearly result in the division of interpolation regions into seven values, with each having an assigned number that would be in format like unto the system recited in claim 13, where each direction value would take on the values of the directions recited in Greggain. Further, in 7:30-67 it is clearly taught that the quadrant of the (e.g. the determination of position) is made based on a computed alpha value for determining the directionality for the intermediate pixels. This clearly illustrates the principle of linear change based on determined direction, as illustrated in 7:53-60. As taught in 8:25-38, based on the direction, the direction is found by interpolating linearly between the endpoints of the interpolated pixel, and based on the concept of the intermediate pixel. The concept of alpha – positive or negative for both x and y axes allows a quick determination of whether or not the pixels is above or to the left of the pixel being interpolated, which then fulfills the recited limitation of linear change between a pixel above or the left and a pixel below or to the right, as clearly those pixels are necessary to form the endpoints for determining the direction as recited 8:25-40. Motivation and combination are taken from the rejection to claim 10 above.

Allowable Subject Matter

Claims 11, 13-14, 18, and 20-21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

These claims are allowable for several reasons. First of all claims 11 and 18 represent a specific implementation of a low-pass filter with specific coefficients for this application. This combination of coefficients has not been found in the prior art for this application. Secondly, claims 13 and 20 simply contain too much detail and new material to find comparable background in the prior art, with particular emphasis on the weighting factors, the specific implementations of the mappings to the threshold values, and the details on the direction. Lastly, the L-coefficient polynomials in claims 14 and 21 are not present in the prior art as far as examiner can determine.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric Woods whose telephone number is 571-272-7775. The examiner can normally be reached on M-F 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Eric Woods

August 7, 2006

Jeffery A. Brier
JEFFERY BRIER
PRIMARY EXAMINER